

IN THE CLAIMS:

Rewrite the pending claims and add new claims as follows:

1. (Currently amended) A method for generating GPS satellite clock corrections, comprising:

obtaining dual-frequency pseudorange code measurements and carrier-phase measurements from a plurality of satellites;

for each of the plurality of satellites, forming a smoothed refraction-corrected code measurement based on the dual-frequency pseudorange code measurements and carrier-phase measurements from the satellite, wherein the forming is performed for each of a series of measurement epochs preceding and including a current measurement epoch, wherein forming the smoothed refraction-corrected code measurement at the current measurement epoch includes smoothing refraction-corrected code measurements with refraction-corrected carrier phase measurements, and wherein smoothing the refraction-corrected code measurement includes forming projections of the smoothed refraction-corrected code measurements using changes in the carrier-phase measurements between two consecutive measurement epochs and computing an expanding average of differences between the projections and the refraction-corrected code measurements over a series of measurement epochs; and

computing clock corrections for the plurality of satellites based on the smoothed refraction-corrected code measurements.

2. (Cancelled).

3. (Currently amended) The method of claim 1 wherein smoothing the refraction-corrected code measurement comprises:

computing a smoothed offset between the refraction corrected code measurements and the refraction corrected carrier-phase measurements; and

forming the smoothed refraction corrected code measurement by adding the refraction corrected carrier-phase measurement at the current measurement epoch to the smoothed offset.

4. (Cancelled)

5. (Currently amended) ~~The method of claim 1~~ A method for generating GPS satellite clock corrections, comprising:

obtaining dual-frequency pseudorange code measurements and carrier-phase measurements from a plurality of satellites;

for each of the plurality of satellites, forming a smoothed refraction-corrected code measurement based on the dual-frequency pseudorange code measurements and carrier-phase measurements from the satellite; and

computing clock corrections for the plurality of satellites based on the smoothed refraction-corrected code measurements;

wherein the dual-frequency pseudorange code measurements and carrier-phase measurements from each of the plurality of satellites includes a pseudorange code measurement and a carrier-phase measurement corresponding to each of two carrier signal frequencies and at each of a series of measurement epochs, and wherein forming the smoothed refraction-corrected code measurement for each satellite comprises:

for each of the series of measurement epochs and for each carrier signal frequency, forming a linear combination of the carrier-phase measurements corresponding to the two carrier signal frequencies from the satellite, such that the linear combination of the carrier-phase measurements matches ionospheric refraction effects on the pseudorange code measurement for the carrier signal frequency from the satellite;

forming a smoothed code measurement for each carrier signal frequency by smoothing the pseudorange code measurements for the carrier signal frequency with the matching linear combinations of the dual-frequency carrier-phase measurements; and

computing the smoothed refraction-corrected code measurement based on the smoothed code measurements for the two carrier signal frequencies.

6. (Currently amended) ~~The method of claim 1~~ A method for generating GPS satellite clock corrections, comprising:

obtaining dual-frequency pseudorange code measurements and carrier-phase measurements from a plurality of satellites;

for each of the plurality of satellites, forming a smoothed refraction-corrected code measurement based on the dual-frequency pseudorange code measurements and carrier-phase measurements from the satellite; and

computing clock corrections for the plurality of satellites based on the smoothed refraction-corrected code measurements;

wherein the dual-frequency pseudorange code measurements and carrier-phase measurements are obtained at a reference GPS receiver having a known location and wherein computing the clock corrections comprises:

computing a residual for each of the plurality of satellites by subtracting a theoretical range between the reference GPS receiver and the satellite from the smoothed refraction-corrected code measurement for the satellite;

forming a mean receiver clock error as a linear combination of the residuals for the plurality of satellites; and

computing a clock correction for each of the plurality of satellites by subtracting the mean receiver clock error from the residual computed for the satellite.

7. (Original) The method of claim 6 wherein the theoretical range includes an adjustment for tropospheric effects.

8. (Original) The method of claim 6 wherein the theoretical range includes an adjustment for satellite orbital errors.

9. (Original) The method of claim 6 wherein the linear combination of the residuals for the plurality of satellites includes a weighted combination of the residuals according to elevation angles of the plurality of satellites as observed by the reference GPS receiver.

10. (Original) A method for generating satellite clock corrections for a wide-area GPS network having a plurality of reference stations including a master reference station and a plurality of local reference stations, comprising:

for each reference station, obtaining a smoothed refraction-corrected code measurement for each satellite visible to the reference station formed using GPS measurements taken from the satellite at the reference station;

computing a master clock correction for each satellite visible to the master reference station using the smoothed refraction-corrected code measurements for the master reference station;

for each of the plurality of local reference stations, computing a local clock correction for each satellite common to the master reference station and the local reference station using

smoothed refraction-corrected code measurements for the master reference station and for the local reference station; and

computing an average clock correction for each satellite visible to the master reference station by forming a linear combination of the master clock correction and the local clock corrections computed for the satellite.

11. (Original) The method of claim 10 wherein computing local clock corrections and computing average clock corrections are iterated and the average clock corrections in one iteration round is used to compute the local clock corrections in a next iteration round.

12. (Original) The method of claim 11 wherein the linear combination for the average clock correction is weighted according elevation angles at which the satellite is visible to the master reference station and to the local reference stations.

13. (Original) The method of claim 10 wherein the theoretical range between a reference station and a satellite visible to the reference station includes an adjustment for the tropospheric refraction effects on the GPS measurements obtained at the reference station for the satellite.

14. (Original) The method of claim 10 wherein the theoretical range between a reference station and a satellite visible to the reference station includes an adjustment for the satellite orbital errors in the GPS measurements obtained at the reference station for the satellite.

15. (Original) The method of claim 10 wherein for each reference station and for each satellite visible to the reference station, the smoothed refraction-corrected code measurement is formed by:

forming refraction-corrected code measurements and refraction-corrected carrier-phase measurements using dual-frequency GPS pseudorange measurements and carrier-phase measurements, respectively, taken from the satellite at the reference station at a series of measurement epochs; and

smoothing the refraction corrected code measurements with the refraction corrected carrier-phase measurements.

16. (Original) The method of claim 10 wherein for each reference station and for each satellite visible to the reference station, the smoothed refraction-corrected code measurement is formed by:

forming at each of a series of measurement epochs and for each carrier signal frequency a linear combination of dual frequency carrier-phase measurements such that the linear combination matches the ionospheric refraction effect on the corresponding pseudorange code measurement;

computing a smoothed code measurement for each carrier signal frequency by smoothing the pseudorange code measurements for the carrier signal frequency with the matching linear combinations of the dual frequency carrier-phase measurements; and

combining the smoothed code measurements to form the smoothed refraction-corrected code measurement.

17. (Original) The method of claim 10 wherein computing the master clock correction for each satellite visible to the master reference station comprises:

obtaining a master residual for each satellite visible to the master reference station, the master residual being an offset of the smoothed refraction-corrected code measurement for the satellite for the master reference station from a theoretical range between the satellite and the master reference station;

computing a master mean receiver clock error based on the master residuals; and
subtracting the master mean receiver clock error from the master residuals.

18. (Original) The method of claim 17 wherein computing the master mean receiver clock error comprises forming an average of the master residuals over the satellites visible to the reference station.

19. (Original) The method of claim 17 wherein computing the master mean receiver clock error comprises forming a linear combination of the master residuals weighted by elevation angles of the satellites as observed by the master reference station.

20. (Original) The method of claim 17 wherein computing the local clock corrections for a local reference station comprises:

obtaining a local residual for each satellite common to the master reference station and the local reference station, the local residual being an offset of the smoothed refraction-

corrected code measurement for the satellite for the local reference station from a theoretical range between the satellite and the local reference station;

computing a local mean receiver clock error based on the local residuals and the master residuals; and

subtracting the local mean receiver clock error from the local residuals.

21. (Original) The method of claim 20 wherein computing the local mean receiver clock error comprises:

for each satellite common to the local reference station and the master reference station, computing an offset of the local residual from the master residual; and

forming a linear combination of the offsets over the satellites common to the local reference station and the master reference station.

22. (Original) The method of claim 21 wherein the offsets in the linear combination are weighted by elevation angles of the satellites as observed by the local reference station.

23. (Currently amended) A method for forming a smoothed refraction-corrected code measurement based on dual-frequency GPS pseudorange measurements and carrier-phase measurements taken from a satellite by a GPS receiver, comprising:

for each of a series of measurement epochs preceding and including a current measurement epoch, forming a refraction-corrected code measurement based on the dual frequency pseudorange code measurements from the satellite and a refraction-corrected carrier-phase measurement based on the dual-frequency carrier phase measurements from the satellite; and

smoothing the refraction-corrected code measurements with the refraction-corrected carrier phase measurements to obtain a smoothed refraction-corrected code measurement at the current measurement epoch,

wherein smoothing the refraction-corrected code measurement includes forming projections of the smoothed refraction-corrected code measurements using changes in the carrier-phase measurements between two consecutive measurement epochs, and computing an expanding average of differences between the projections and the refraction-corrected code measurements over a series of measurement epochs.

24. (Original) The method of claim 23 wherein smoothing the refraction-corrected code measurement comprises:

computing a smoothed offset between the refraction corrected code measurements and the refraction corrected carrier-phase measurements; and

forming the smoothed refraction corrected code measurement by adding the refraction corrected carrier-phase measurement for the current measurement epoch to the smoothed offset.

25. (Canceled)

26. (Currently amended) A method for forming a smoothed refraction-corrected code measurement based on dual-frequency GPS pseudorange measurements and carrier-phase measurements taken from a satellite at a GPS receiver, comprising:

forming at each of a series of measurement epochs and for each carrier signal frequency a linear combination of the dual-frequency carrier-phase measurements to match the ionospheric refraction effect on the corresponding pseudorange code measurement;

forming a smoothed code measurement for each carrier signal frequency by smoothing the pseudorange code measurements with the matching linear combinations of the dual-frequency carrier-phase measurements; and

combining the smoothed code measurements to form the smoothed refraction-corrected code measurement,

wherein combining the smoothed code measurements to form the smoothed refraction-corrected code measurement includes forming projections of the smoothed refraction-corrected code measurements using changes in the carrier-phase measurements between two consecutive measurement epochs. and computing an expanding average of differences between the projections and the refraction-corrected code measurements over a series of measurement epochs.

27. (Currently amended) A computer readable medium comprising computer executable program instructions that when executed cause a digital processing system to perform a method for generation GPS satellite clock corrections, the method comprising:

obtaining dual-frequency pseudorange code measurements and carrier-phase measurements from a plurality of satellites;

for each of the plurality of satellites, forming a smoothed refraction-corrected code measurement based on the dual-frequency pseudorange code measurements and carrier-phase measurements from the satellite, wherein the forming is performed for each of a series of

measurement epochs preceding and including a current measurement epoch, forming the smoothed refraction-corrected code measurement at the current measurement epoch includes smoothing refraction-corrected code measurements with refraction-corrected carrier phase measurements, and wherein smoothing the refraction-corrected code measurement includes forming projections of the smoothed refraction-corrected code measurements using changes in the carrier-phase measurements between two consecutive measurement epochs and computing an expanding average of differences between the projections and the refraction-corrected code measurements over a series of measurement epochs; and

computing clock corrections for the plurality of satellites based on the smoothed refraction-corrected code measurements.

28. (Original) A computer readable medium comprising computer executable program instructions that when executed cause a digital processing system to perform a method for generation satellite clock corrections for a wide-area GPS network having a plurality of reference stations including a master reference station and a plurality of local reference stations, the method comprising:

for each reference station, obtaining a smoothed refraction-corrected code measurement for each satellite visible to the reference station formed using GPS measurements taken from the satellite at the reference station;

computing a master clock correction for each satellite visible to the master reference station using the smoothed refraction-corrected code measurements for the master reference station;

for each of the plurality of local reference stations, computing a local clock correction for each satellite common to the master reference station and the local reference station using smoothed refraction-corrected code measurements for the master reference station and for the local reference station; and

computing an average clock correction for each satellite visible to the master reference station by forming a linear combination of the master clock correction and the local clock corrections computed for the satellite.